

Magnetic Stick, D.C. Plug-In Relay PP-151 (Second Generation)

US&S Part Nos.
N322507701
N322507703
N322516701
N437657
N438007802
N438007804



- Installation
- Operation
- Troubleshooting

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Revision History

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1. GENERAL INFORMATION

This manual provides service information for the PP-151 magnetic stick dc plug-in relay.

The design of the PP-151 relay conforms to all applicable Association of American Railroads (AAR) specifications.

1.1. Description

The PP-151 relay is a dual magnetic stick relay which stays in the last operated position after control energy is removed. Full contact pressure is maintained during de-energization to ensure circuit continuity. There are two types of PP-151 relays, wayside and car carried. The wayside type is designed for use in polar control, indication circuits, and switch control. The switch control relay is used in conjunction with or to control type PN-150BM relays.

The PP-151 relay has two permanent magnets, and an armature which is pivoted in the center.

The relay is factory calibrated to operate across a wide environmental range. All moving parts are enclosed in a sturdy, transparent, dust and moisture resistant cover. To ensure the relay is inserted in its proper mounting base, all relays have indexing pins. Relays lock securely into the plug-in position.

1.1.1. Coils

Coil resistances of PP-151 relays are as follows: a) car carried, 400/400 ohms; b) wayside, 25, 240, and 400 ohms. Refer to paragraph 1.2.1 to correlate part numbers to coil resistance values. The resistance selected depends on the system voltage and circuitry.

1.1.2. Contacts

Contacts of PP-151 relays are 6 normal and reverse silver-to-silver-impregnated carbon, except for the wayside switch control type relay which has 4 normal and reverse silver to silver-impregnated carbon, and 2 normal and reverse, silver to silver.

1.2. SPECIFICATIONS

The following paragraphs provide the electrical and mechanical specifications of the PP-151 magnetic stick relays covered in this manual.

1.2.1. Electrical

Relay electrical specifications are tabulated below:

General Information

Part No. With Front Testing	Part No. Without Front Testing	Contacts	Coil Resistance ohms	Max. Polar Pick Up & Working Volts	Min. Polar P.U. working volts	See Note
N322507-701		6 NR SIC	240	5.52	4.25	
N322507-703		6 NR SIC	25	1.54	1.2	1
N322516-701		4 NR SIC	240	5.52	4.25	2
		2 NR Sil				
N438007-802		6 NR SIC	400	6.85	5.3	
	N438007-804	6 NR SIC	400	6.85	5.3	
	N437657	6 NR SIC	400/400	9.6	7.4	3

Note:

- 1 Wayside Relay, normally used in series with other relay for polar control and indication circuits
- 2 Wayside Relay, used in combination with PN-150BM for switch control
- 3 Car carried Relay

Contacts: SIC - Silver to Silver-Impregnated Carbon Normal and Reverse
 Sil - Sil - Silver to Silver Normal and Reverse

1.2.2. Mechanical

The following mechanical specifications are common to all PP-151 relays covered in this manual.

Dimensions: Height 7-1/16" (17.93 cm)

Width 2-7/16" (6.19 cm)

Depth 8-3/8" (21.27 cm)

Temperature: -40°F (-40°C) to +185°F (85°C)

Indexing Refer to Section 2.3

Weight 7.0 Lbs. (3.175 kg)

Mounting Base N341785 Wayside (Old Style)

N437090 - Car carried (Old Style)

N451376-0302 - All Above (Improved Style)

Mounting Base Weight 17.5 oz. (Old Style)

Mounting base Dimensions

9.5 oz. (Improved Style)

Height 7-15/16" (20.16 cm)

Width 2-7/16" (6.19 cm)

Depth 2-7/16" (6.19 cm) (old style)

Depth 1-25/32" (4.52 cm) (Improved Style)



2. INSTALLATION

Relays plug directly into a mounting base which is secured to a rack. The only installation instructions required are for the mounting base.

2.1. Mounting Base

Secure the mounting base directly to the rack using the hardware furnished. All wiring terminates at the rear of the mounting base to solderless terminals (receptacle contact springs).

Mounting base details are shown in Figure 5-3 (Old Style Base) and Figure 5-4 (Improved Base) of the Appendix.

2.2. Relay Indexing

Relays are factory equipped with indexing pins to prevent insertion of an incorrect relay into a mounting base. Each relay is accompanied by an indexing plate which is applied to the mounting base at the time of initial installation. A typical plug-in relay with indexing pins and base with indexing plate is shown in Figure 2-1.

The following data defines the indexing that has been established for relays covered by this manual.

- a. The index code always consists of four figures (such as 0001, 0002, or 0101) and is used for both the relay and the indexing plate on the mounting base.
- b. The index code for each relay can be determined from the relay part number and its suffix which is marked on the name plate attached to the front of the relay. The first two digits of the index code are the last two digits of the part number, and the second two digits of the index code are the last two digits of the suffix. The index number thus obtained should agree with the placement of the indexing pins in the numbered vertical rows on the back of the relay starting with the top pin and reading down.
- c. The index code for each mounting base is determined by the placement of the holes in the numbered vertical rows of the large white nylon indexing plate which is affixed to the front of the mounting base. This indexing plate should not be removed from the mounting base unless it is damaged or the indexing is to be purposely changed to accommodate a relay of a different part number. Discard the indexing plate which comes in a bag tied to the handle of all new relays unless it is needed for replacement of damaged indexing plate or for application to a new mounting base.

WARNING

Never drill new holes in a base indexing plate which will permit application of relays with different part numbers or change indexing pins on the back of a relay unless it is being converted to a new part number. Otherwise, a hazard will be created which may compromise safety circuit functions.

2.3. Receptacle Contact Springs**2.3.1. Old Style Base Only**

The mounting base will normally be equipped with the required quantity of J680165 solderless receptacle contact springs, and will accommodate one or two #14-#16 wires. It can, however, be equipped with receptacle contact springs for one or two #10-#12 wires (J680181), or for one or two #18-#20 wires (J680179). Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with their installation.

2.3.2. Improved One Piece Base Only

The one piece mounting base with hardware (N451376-0302) includes a full complement of receptacle contact springs (M451142-2702) to accommodate one or two #14-#16 wires, mounting fasteners, and tags. It can, however, be equipped with receptacle contact springs for one or two #10-#12 wires (M451142-2703), or for one or two #18-#20 (M451142-2701). Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with their installation.

Each solderless receptacle contact springs should be inspected for physical damage and straightness before proceeding with installation.

The following checks are recommended when installing solderless receptacle contact springs:

- a. Receptacle contact springs must be inserted into the base with the lock side down (Refer to Figure 2-2).
- b. Make certain that the lanced tab is slightly compressed as the receptacle contact spring is inserted along the top of the cavity. The lanced tab could have been bent during handling, and therefore would not provide the required contact pressure after the relay is inserted. If the lanced tab does not touch, pull it up slightly using fingers or a suitable tool.
- c. After insertion, pull firmly on the wire to make certain the receptacle contact spring is locked in the receptacle.

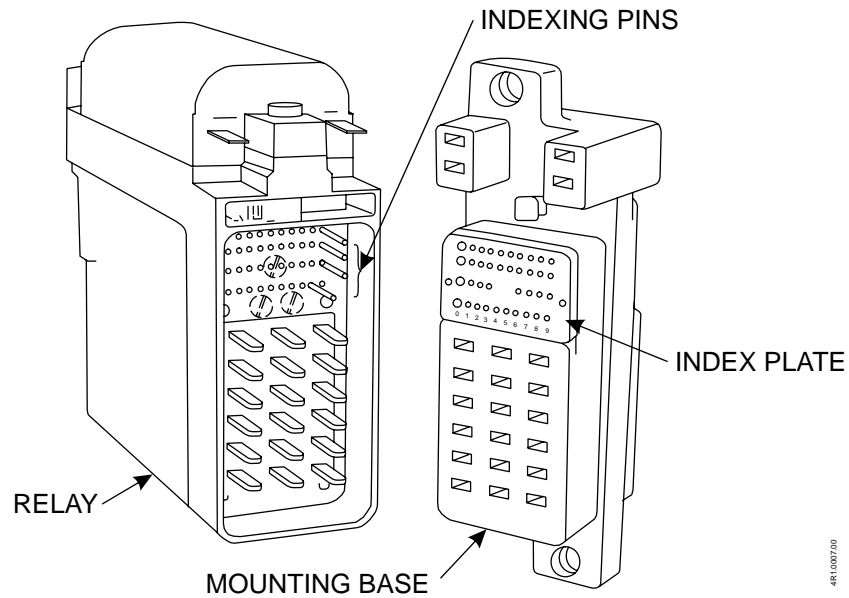


Figure 2-1. Typical Plug-In Relay and Mounting Base

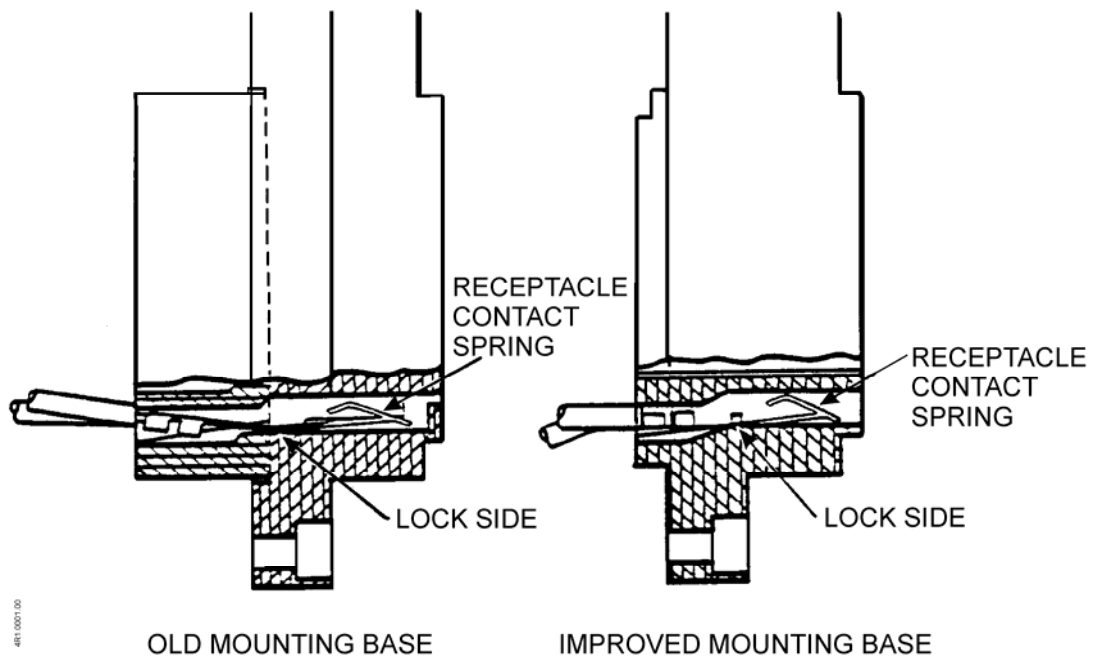


Figure 2-2. Receptacle Contact Spring Installed

Installation

2.3.3. Installing Wires in Receptacle Contact Springs

Use the following procedure to ensure a good electrical and mechanical connection between the conductor wire and the receptacle contact spring. The following table identifies the correct crimping tool to be used when installing wires in receptacle contact springs.

Crimping Tool	Wire Size	Old Style Receptacle contact Spring	Improved Base Receptacle Contact Spring
J397138	#10/#12 AWG	J680181	M451142-2703
J397139	#14/#16 AWG	J680165 (Standard)	19451142-2702
J397188	#18/#20 AWG	J680179	M451142-2701

- Strip 3/16 in. (0.187 in. or 0.47 cm.) of insulation from the end of the wire.
- Place the receptacle contact spring into the jaws of the proper crimping tool. When using only one terminal, of any wire size, use the shortest terminal.
- Partially close the crimping tool jaws against the receptacle contact spring to hold it in place. (Do not crush the receptacle contact spring barrel at this time.)
- Insert the stripped end of wire all the way into the receptacle contact spring barrel. Squeeze the tool handles until crimping is completed and the jaws release. When using both terminals, it is more convenient to attach the first wire to the longest terminal.
- Remove the crimped receptacle contact spring from the tool and inspect the connection. Make certain that the wire is flush with the crimped barrel and that there are no loose strands of wire.

2.3.4. Base Wiring for Wayside or Car Carried Relays

Some PP-151 relays can be used either in wayside or car carried applications. For externally wiring the mounting base see Figure 2-3.

2.4. RELAY INSERTION

2.4.1. Wayside Relays

Orient the relay to the mounting base with the push rod to the left-hand side then plug the relay into the base. The relay should be pushed firmly against the mounting base while depressing the latch rod. After the relay is completely seated in the base, release the latch rod and pull on the handle to ensure that the relay has locked in place.

2.4.2. Car-Carried Relays

Secure the relay to the mounting base with the two mounting bolts (R451299-0102), that pass through the tubes in the relay. Using a torque wrench, tighten the bolts to 25 + 5 inch-pounds, otherwise the operating characteristics of the relay may be changed.

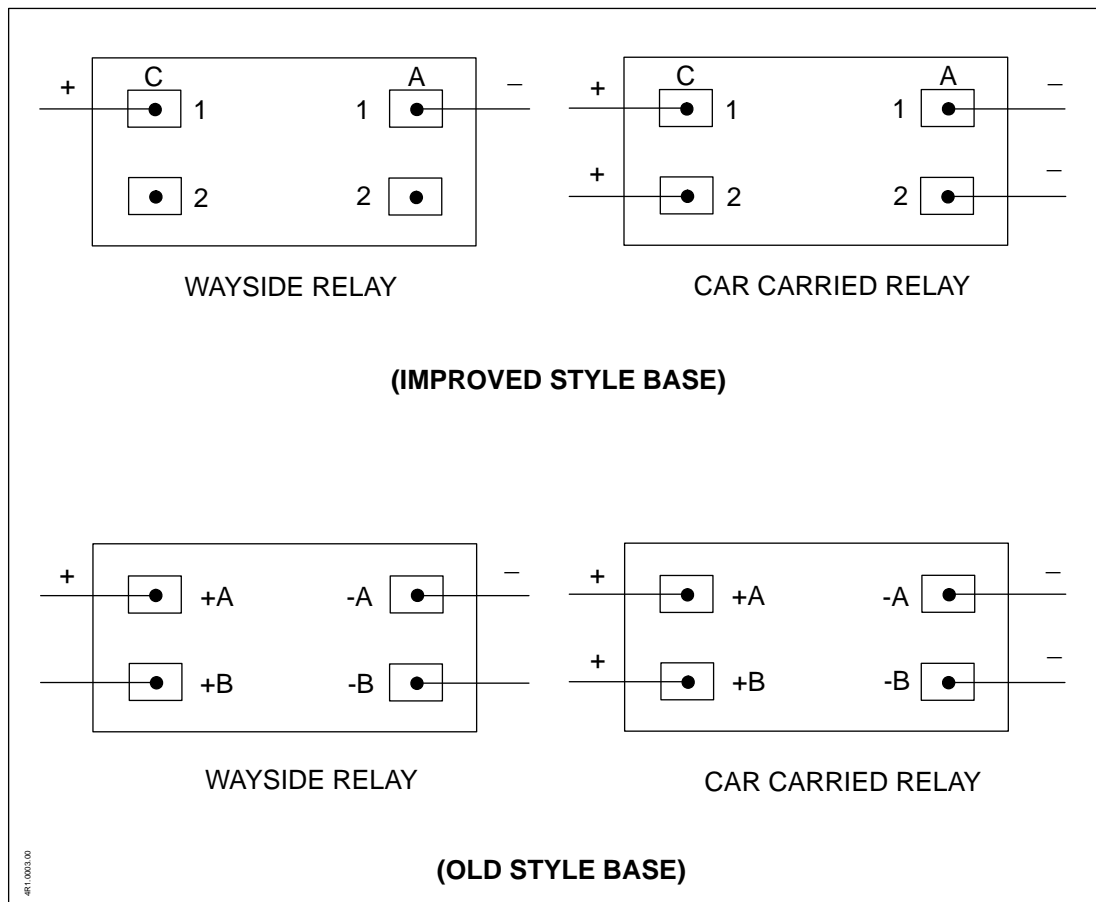


Figure 2-3. External Connections to Mounting Base



3. FIELD MAINTENANCE

This section provides the necessary periodic preventive maintenance procedures which must be performed to ensure continuous, proper, and efficient operation of the PP-151 relays covered in this manual. Field maintenance covers periodic inspections and performance tests.

3.1. PERIODIC PERFORMANCE TEST

3.1.1. Cleaning

Before inspecting and testing the relay, if necessary use a soft cloth to clean the exterior to remove any dirt or dust that may have collected. A safe cleaning solution of alcohol and water or common laundry detergent may be used for removal of accumulated dirt, grease, etc.

3.1.2. Service Requirements

3.2.2.1 General

All vital relays must be inspected and tested at least once every four (4) years. The tests and inspections are to include: pick-up current, drop-away current, timing of slow operating and timing relays; and visual inspection of contacts for damage or misalignment, corrosion or other contamination of parts, loose parts inside of the cover, broken seal, and cracked or broken cover.

All vital relays installed in locomotive or car-carried equipment are to be removed from service and adjusted, repaired and tested at least once every six (6) years.

Relays not passing the above stated tests and inspections must be replaced and not returned to service until the operating characteristics and conditions are in accordance with US&S specifications.

3.2.2.2 In-Service Test

It is recommended that line relays in service be removed from service for shop repairs when one or more of the following conditions occur. (Use as a reference the calibration values given in Table II.)

- a. Pick-up is more than 110% of the new relay value.
- b. Normal and reverse pick-ups differ so that the lower value is less than 70% of the higher value.
- c. The armature fails to complete its stroke on the special test (Par. 4.6.5) on relays with single wound coil.

Field Maintenance

3.2.2.3 Test Procedures

Test the operating characteristics of the PP-151 relays as given in paragraph 4.6.

4. SHOP MAINTENANCE

4.1. INTRODUCTION

This section provides the information necessary to perform shop level repairs of the PP-151 relays covered in this manual. In general, relays arriving at the shop for repair have been checked in the field and have been found to perform unacceptably or have been physically damaged,

4.2. CLEANING AND INSPECTION

Before inspecting the relay and initiating repairs, use a soft cloth to clean the exterior carefully to remove any dirt or dust that may have collected. A safe cleaning solution of alcohol and water or common laundry detergent may be used for removal of accumulated dirt, grease, etc. Inspect the relay exterior for signs of physical damage, such as cracked or broken cover, cracked or damaged housing, and damaged and or missing contact block terminals and indexing pins. If severe damage is found, a careful inspection of the interior components should be made for physical damage.

Remove the cover and proceed with stop pin and relay contact cleaning, using the following recommended cleaning materials:

Recommended Cleaning Materials

Order Reference

A relay contact cleaning kit, part number X451646-0901, is available that consists of the following three items, or which may be ordered individually:

Burnishing Tool, P.K. Neuses Co. No. 3-316

J397187

Burnishing Tool, P.K. Neuses Co. No. N318 (Heavy Duty)

J397187-001

Paper Strip, strips cut from 67 pound white
Springhill Vellum Bristol Paper

J793094 (pkg. of 50)

Also recommended:

Recommended Cleaning Materials

Order Reference

Emery Paper, Wet or dry, 600 Grit, cut in strips

(Commercially Available)

Stop Pin Conditioning Graphite Stick

N451151-3203

4.2.1. Armature Stop Cleaning

The following instructions are for cleaning the armature stop pin (see Figure 4-1). This procedure should be followed wherever a relay is shopped for failure to meet its calibration specifications during scheduled field inspection and tests.

Shop Maintenance

- a. Insert a clean paper strip (J793094) between the stop pin and relay pole face. Using moderate pressure to hold the armature closed, pull the cleaning strip back and forth in a circular motion over the stop pin. Continue this process until it is apparent that no foreign substances are being transferred to the strip.
- b. The next step is to apply a dry lubricant such as graphite to the relay stop pin and its point of contact on the pole face.
 1. Insert the Stop Pin Conditioning Graphite Stick between the armature stop pin and its point of contact on the pole face with graphite against stop pin. While applying moderate pressure on the stick, pull the stick back and forth, and in a circular motion over the stop pin, continuing several seconds to ensure a sufficient amount of graphite transfer.
 2. It is not necessary to observe significant deposits of graphite since most of what is required can only be determined by means of a microscope.
- c. Recheck relay calibration and prepare relay for return to service.

4.2.2. Cleaning Relay Contacts

This section covers recommended methods for the preparation and cleaning of relay contacts.

After contacts have been dressed and/or after adjustments have been made to meet calibration requirements, the contacts should be cleaned in accordance with the following procedure.

NOTE

When using the paper strip, clean the back contacts first, and then the front contacts last. Discard the paper strips when dirty.

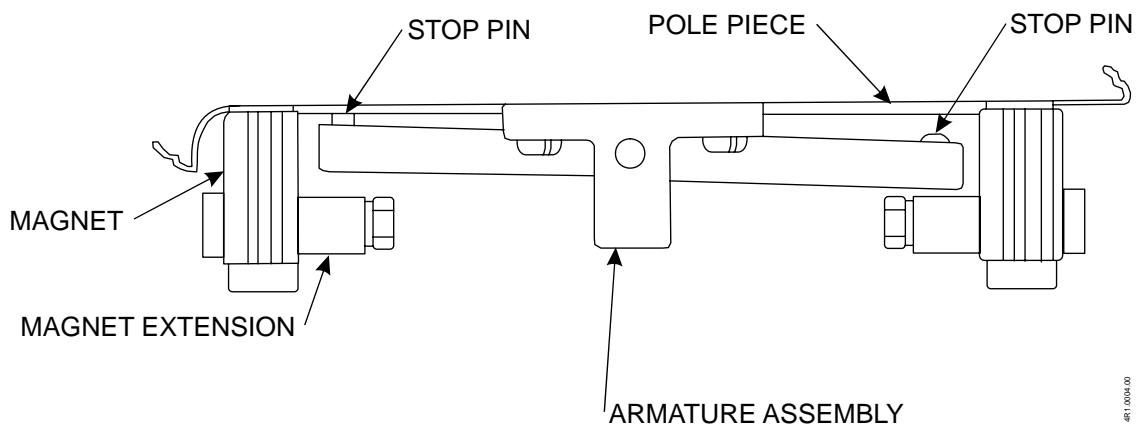


Figure 4-1. Armature stop Pin Location

4.2.2.1. Contacts that are Severely Burned

- a. Using a 600 grit emery paper strip folded with the grit side out so that both contacts can be burnished simultaneously, stroke the contacts in the direction of contact wipe.
- b. Using the burnishing tool, stroke the contacts several times in the direction of contact wipe.
- c. Place the paper strip between the open contacts, then close the contacts and withdraw the paper strip.
- d. Repeat step c several times if necessary.
- e. Place the paper strip between the open contacts, then close the contacts and withdraw the paper strip.
- f. Repeat step f several times if necessary.

4.2.2.2. Contacts with Heavy Tarnish, Slightly Rough or Pitted

- a. Perform the procedure in paragraph 4.2.2.1, Steps b to f.

4.2.2.3. Contacts with Surface Film or oxidation (Not Pitted)

- a. Perform the procedure in paragraph 4.2.2.1, Steps e and f.

4.3. CHECK-OUT PROCEDURE (Performance Test)

Perform calibration in accordance with paragraph 4.6.

4.4. REPAIRS AND REPLACEMENT

Since the contacts and armature bushings are the only wearing parts in this relay, in most cases the relay can be restored to proper operation by dressing (Paragraph 4.2.2) and readjusting (paragraph 4.5.6.3) the contacts, or repairing the armature.

4.4.1. Recommended Tools

Twist Drill - #42

Screw Driver - Torque Measuring

4.4.2. Disassembly

Dismantle the relay only to the degree necessary to complete repairs. Refer to the parts list appendix for part information and location of parts. In general, to dismantle the plug-in relay, proceed with the following sequencer

Shop Maintenance

- a. Remove relay cover seal.
- b. Carefully remove plastic cover.
- c. Remove/disassemble relay components as required.
- d. Remove contacts/contact block as required.
- e. Remove permanent magnet only if required.

NOTE

These magnets are of a special alloy that permits retention of proper strength indefinitely if not abused. When not in place on relays, magnet assemblies should be kept separated from other magnetic objects, and the screws, which hold the extension to the magnet be kept tight. Should a magnet become weakened, it should be returned to the factory for recharging by the special equipment required to fully charge the magnet. It will then be aged to its best working strength.

4.4.3. Reassembly

Reassembly is accomplished generally in the reverse order of disassembly. The following paragraphs provide additional instructions to be followed during reassembly of this relay.

4.4.3.1. General Parts Replacement

Do not over tighten of force parts when reassembling a relay. Upon completion of reassembly, calibrate the relay as directed in paragraph 4.6.

4.4.3.2. Replacing Contact Block

If the contact block is to be replaced by another, remove the old block, then use a small punch to remove the small dowel pins. Attach the _new block with the four screws. Torque the contact block screws to 10(\pm 2) inch pounds. Run a #42 drill (0.0935 Dia.) thru the dowel pin holes into the epoxy contact block for a total depth of 9/16" + 1/32 - 0.

NOTE

Replacement contact blocks MUST be of the same general design.

Carefully install the dowel pins, tapping-in until they are flush with the surface.

If it is necessary to install a used contact clock from another relay, remove only one of the dowel pins from the aluminum frame. Carefully press the block on the remaining pin and fasten in place with the screws. One dowel pin will adequately hold the block in place.

Do not over tighten or force parts when reassembling a relay. Upon completion of reassembly, calibrate the relay as directed in paragraph 4.6.

4.4.3.3. Permanent Magnet

The polarity of the magnet should be such that the top end farthest from the two notched holes will attract the end of a compass needle which points toward geographic South.

The permanent magnet assembly should be applied to the relay as shown in Figure 4-2 making sure that the magnet is touching the pole piece. Tighten the two long screws holding the magnet assembly to the pole piece sufficiently to straighten the curved strap against the magnet. Bend the nut locks securely up against the sides of the screw head after the adjustments are made.

4.5. ADJUSTMENTS

All adjusting and testing must be done with the relay in its normal operating position.

4.5.1. Recommended Tools and Test Equipment

<u>Item</u>	<u>Part Number</u>
Gap Gauge – 0.001 in. to 0.200 in.	(Commercially Available)
Gram Gauge – 0-400 Grams	(Commercially Available)
Bending Tool	(Commercially Available)

4.5.2. Armature Air Gap

The physical air gap at the center of each armature tip shall be as close as possible to a nominal 0.017" at the center of the tip. The physical air gap at other points of the armature tips shall not vary from the nominal value by more than plus or minus 0.002" (0.015" Min., 0.019" Max. for nominal air gap of 0.017").

Side play between the armature bushings and pivots should be 0.002" to 0.0035". End play should be held to 0.010" Min, to 0.020" Max.

The Stop Pin shall strike the pole face as nearly flat across its surface as possible, and it is permissible for light to be barely visible across 25% of the diameter of the pin on one side only.

The Safety Stop Pins must not touch the pole faces, and with the armature assembly tightened to the relay frame, the armature must not be off center more than 0.015" at either pole piece.

4.5.3. Permanent Magnet

With the magnet against the pole piece and the front permanent magnet extension clamping screws loosened slightly and the back stop pin against the pole face, adjust the front air gap between the armature stop pins and the permanent magnet extension to a nominal value of 0.012" shown in Table I, Test #1. Neither stop pin should project over the edge of the permanent magnet extension. The extension must be securely clamped and the screw heads locked with the lock washers provided.

The rear air gap should be adjusted to a nominal value of 0.012" in a similar manner.

4.5.4. Armature Stroke

The armature stroke shall be a minimum of 0.170" and maximum of 0.190" measured at the stop pin. Care should be taken that the armature is not permitted to touch or approach closely the engaging faces of both permanent magnet extensions at the same time. It is possible that such improper handling would decrease the residual magnetism of the permanent magnets.

If necessary in order to meet calibration requirements, the permanent magnet extensions may be raised or lowered. It will be permissible to change this air gap using spacers between the limits of 0.008" to 0.018".

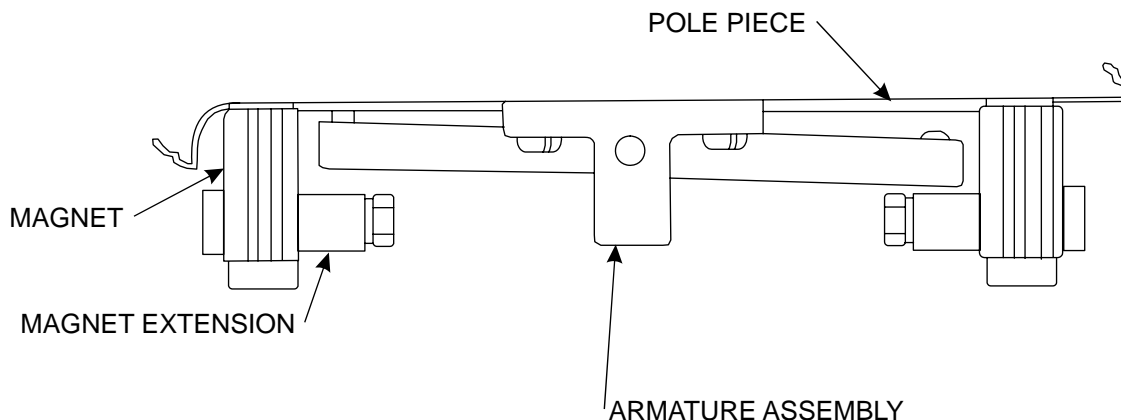


Figure 4-2. Assembly of Permanent Magnet

4.5.5. Indicator

Adjustment of the armature position indicator after calibration should be made so that the bottom of the painted surface is viewed from the front of the relay with rover applied and the indicator should be in full view with the armature in the normal position, and should be hidden with the armature in the reverse position.

4.5.6. Contacts

Contact surfaces should not be disturbed unless there is evidence of severe pitting from excessive loading or an accidental short through the contacts. In case contacts must be dressed and/or after adjustments have been made to meet calibration requirements, clean the contacts in accordance with the instructions in paragraph 4.2.2 of this manual.

4.5.6.1. Pre-adjustment

Pre-adjust the contacts with the contact block mounted on the relay frame if necessary, but do not set them to meet calibration. Best contact stability is obtained by slightly over-bending the spring and returning it to the desired position.

4.5.6.2. Adjustment Limits

The contacts are to be adjusted to just touch when using "closed" spacer. As a guide, there should be no more than 2 grams spring pressure between the contact tips. For any contact adjusted-open (using nominal spacers per Table No. 1), a 0.005" thinner spacer for the fronts and the backs must allow the contacts to be closed. Both contacts should be touching at the "closed" spacers. It is permissible for light to be perceptible on one tip, but both must be touching (no tight perceptible) at full stroke.

When the armature is held at mid-stroke (neither fronts nor backs touching), all heel springs should rest flat against the bottom edge of the driver slot. For those relays which do not meet the above condition, there is a maximum clearance allowable of 0.010 between the bottom of the heel spring and driver slot. Under no circumstance is the upper edge of the heel spring clip to be below the bottom of a driver slot. Also, no heel spring is permitted to rub against the sides of the driver. The driver clip on the armature has slotted holes to allow the clip to be adjusted so that no rubbing is evident.

4.5.6.3. Adjustment Procedure

- a. Plug relay into appropriate mounting base on test stand.
- b. Check heel springs for bow and adjust as required.
- c. Place contact driver in position on relay.
- d. Insert reverse (front) contact open spacer (nominal 0.045 inch) per Table I, Test 2a over the front stop pin and hold firmly by energizing the relay with reverse polarity.
- e. Adjust the reverse (Front) contacts to just open.
- f. Replace the reverse (front) open spacer with the reverse closed spacer (0.040 inch) per Table I, Test 2b. The contacts should be just closed.

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- g. Insert the normal (back) contact open spacer (nominal 0.045 inch) per Table I, Test #3 over the rear stop pin and hold firmly, by energizing the relay in the normal direction.
- h. Adjust the normal (back) contacts to just open.
- i. Replace the normal (back) open spacer with the normal closed spacer (0.040 inch) per Table 2, Test #4 The contacts should be just closed.
- j. Remove the operating arm using Tool N451151-2801. There should be 0.010 inch opening at the normal and reverse contacts.
- k. Repeat Steps c through i and check that the contacts are just open on the contacts open spacer and just closed on the contacts closed spacer.
- l. Check that when the contacts are just closed, the opposite contacts are open at least 0.020 inch.
- m. Check that when the stop pin is against the pole piece, the opposite contacts are open at least 0.050 inch and the contact stops have light perceptible (approximately 0.003 inch opening).

4.6. CALIBRATION

4.6.1. Recommended Test Equipment

Table 4-1. Recommended Test Equipment

NOMENCLATURE	PART/MODEL/TYPE NO.
Power Supply, 0-40 VDC	HP6205B or equivalent
Digital Multimeter (two required)	HP3435A or equivalent
DPDT Switch (S1)	
SPST Switch (S2)	

4.6.2. Polarity

See Figure 2-3. The polarity should be checked as follows: With the positive power lead connected to the "+" or "+A" coil terminal, the negative power lead connected to the "-" or "-B" coil terminal or the center tap connection of the coil, and the relay energized at the "charge" value, the lower (normal) contacts shall be closed.

4.6.3. Procedure

Connect the circuit as shown in Figure 4-3, and proceed as follows:

- a. Set ammeter to appropriate current range.
- b. Set voltmeter to appropriate voltage range.

- c. Set dc power supply to appropriate output range.
- d. Set switch S1 to Normal.
- e. Turn dc power supply on, and close S2.
- f. Observe ammeter and adjust dc power supply output control to obtain the charge current reading indicated in the Amps portion of the Charge column in Table 4-2. Note that relay energizes and remains energized as voltage is increased.
- g. Set switch S1 to Reverse. Relay should energize in the reverse position.
- h. Set switch S1 to Normal. Relay should energize in the normal position.
- i. Reduce the dc power supply output to zero, set switch S1 to REVERSE and slowly increase the output until the armature reverses. The value of energization at which the armature reverses should be between the MIN. and MAX. values given in Table 4-2.
- j. Repeat steps "g" through "i" but reverse the polarities.
- k. The Normal and Reverse values should be within 12% of each other.

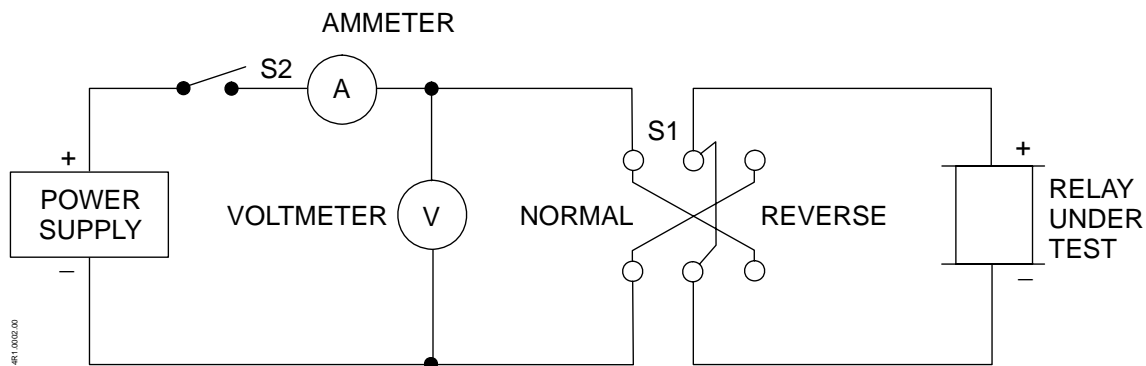


Figure 4-3. PP-151-Relay Test Circuit

4.6.4. Armature Travel

When the polar reversal value is being measured, the armature shall start the travel from the stop on the one side and shall continue its travel until it comes to rest on the opposite stop. When the armature is slowly pulled away by hand from its last energized position, but not far enough to open the contacts on that side, it should return to its stop when released.

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4.6.5. Special Test

This test applies to relays *with* single wound coil only. Connect the relay, according to the circuit shown in Figure 4-4 and apply 50% of the charge value. When the energization is pole changed the armature must travel from stop pin to stop pin. Repeat test on all contacts.

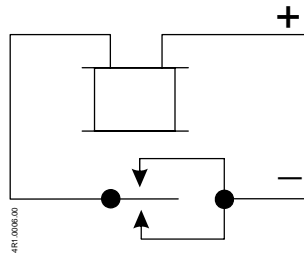


Figure 4-4. Circuit for Special Test

4.7. CALIBRATION REQUIREMENTS

4.7.1. Hold Down Torque

After the relay has been adjusted to meet calibration requirements, the force required to move the armature away from either permanent magnet extension should be approximately 420 grams. This value should be measured at the bottom and center of the molded driver, and is the upward force in grams required to move the armature away from the permanent magnet. When measured, the value must not be less than the value given in Table 4-2.

4.7.2. Contact Resistance

Resistance of front contacts should be measured with the armature in its full-stroke position, and resistance of back contacts should be measured with the armature fully released. Cleaned contact resistance should not exceed the following values.

<u>Type of Contacts</u>	<u>Front Contacts</u>	<u>Back Contacts</u>
Silver to Silver-Impregnated Carbon	0.09 ohms	0.18 ohms
Silver to Silver	----	0.03 ohms

Table 4-2. Table I - Adjustment and Calibration Values for PP-151 Relay

Test No.	Test	Nom.	Min.	Max.	Remarks
1	Permanent Magnet Assembly	0.012"	0.008'	0.018°	Spacer between permanent magnet ext. and armature stop pins
2a	Reverse Contact Adjustment (front)	0.045"	0.040"	0.050"	Front stop-pin spacer. Contact just open.
3	Normal Contact Adjustment (back)	0.045"	0.040"	0.050"	Back stop-pin spacer. Contact just open.
4	Normal Contact Adjustment (back)	0.040"	0.035"	0.045 ⁰	Back stop-pin spacer. Contact must close.
5a	Contact Openings	---	0.020 ¹	---	With opposite contacts just closed.
5b	Contact Openings	---	0.050"	---	Armature against either pole piece.
5c	Reverse & Normal Contact Openings	---	0.010'	---	With operating arms removed.
6	Polarity Test	Charge Value			Plus lead on upper left mounting base receptacle (viewed from front), reverse contact must be closed. Plus lead on upper right mounting base receptacle (viewed from front), normal contacts must be closed.
7	Polar Pick-up and working	---	Table II	Table II	After charge. To reverse armature.
8	Normal and Reverse Difference	---	---	108	After cover has been applied. Permissible variation of polar.
9	Special Test (Using circuit of Figure 4-4) (All contacts)	---	---	50% Charge	Armature must go from stop pin to stop pin with 50% of charge energization.
10	Hold Down Torque -- 6 Pt.	420 grams	350 grams	500 grams	Force on bottom contact engaging pin of operating arm to pull armature from permanent magnet after energizing only to level required to cause reversal of armature to side being tested.
11	Final Electrical Inspection				Recheck tests 6 to 9 with cover applied.
12	Heel Contact Spacer	1/2 of Armature Stroke			Front and Back Contacts Open

Table 4-3. Table II - PP-151 Polar Relay Calibration values

Relay Resistance ohms	Charge		Maximum Pick-up and Working		Minimum Pick-up and Working		Note
	Amps.	Volts	Amps.	Volts	Amps.	Volts	
25	0.24	6.2	0.062	1.54	0.048	1.2	Wayside Relay Only
240	0.0918	22.0	0.023	5.52	0.0178	4.25	
400	0.0686	27.4	0.0172	6.85	0.0132	5.3	
400/400	0.096	38.4	0.024	9.6	0.0185	7.4	Car Carried Relay Only

5. PARTS LIST

Table 5-1. PP-151 Magnetic Spick DC Relay PNs: N322507-701, 703, N322516-701, N438007-802, 804 (See Figure 5-1)

ITEM NUMBER	DESCRIPTION	PART NUMBER
7	Armature Bracket PN-159B	M436773
8	Armature	N437638001
11	Contact Block	N438627
14	Pull Handle, Aluminum	J561111
22	Molded Relay Cover	J776596
24	Encapsulated Coil: Relay #N322507-701, 240 ohm Relay #N322507-703, 25 ohm Relay #N322516-701, 240 ohm Relay #N438007-802, 400 ohm Relay, #N438007-804, 400 ohm	N333975 N379650 N333975 N321647 N433498
40	Magnet, Permanent	M437642
41	Magnet, Permanent	M437891
42	Arm, Operating	M373632001
44	Latch, Rod	M388888
46	Latch, Machined	M321728
50	Indicator, Arm	M432380

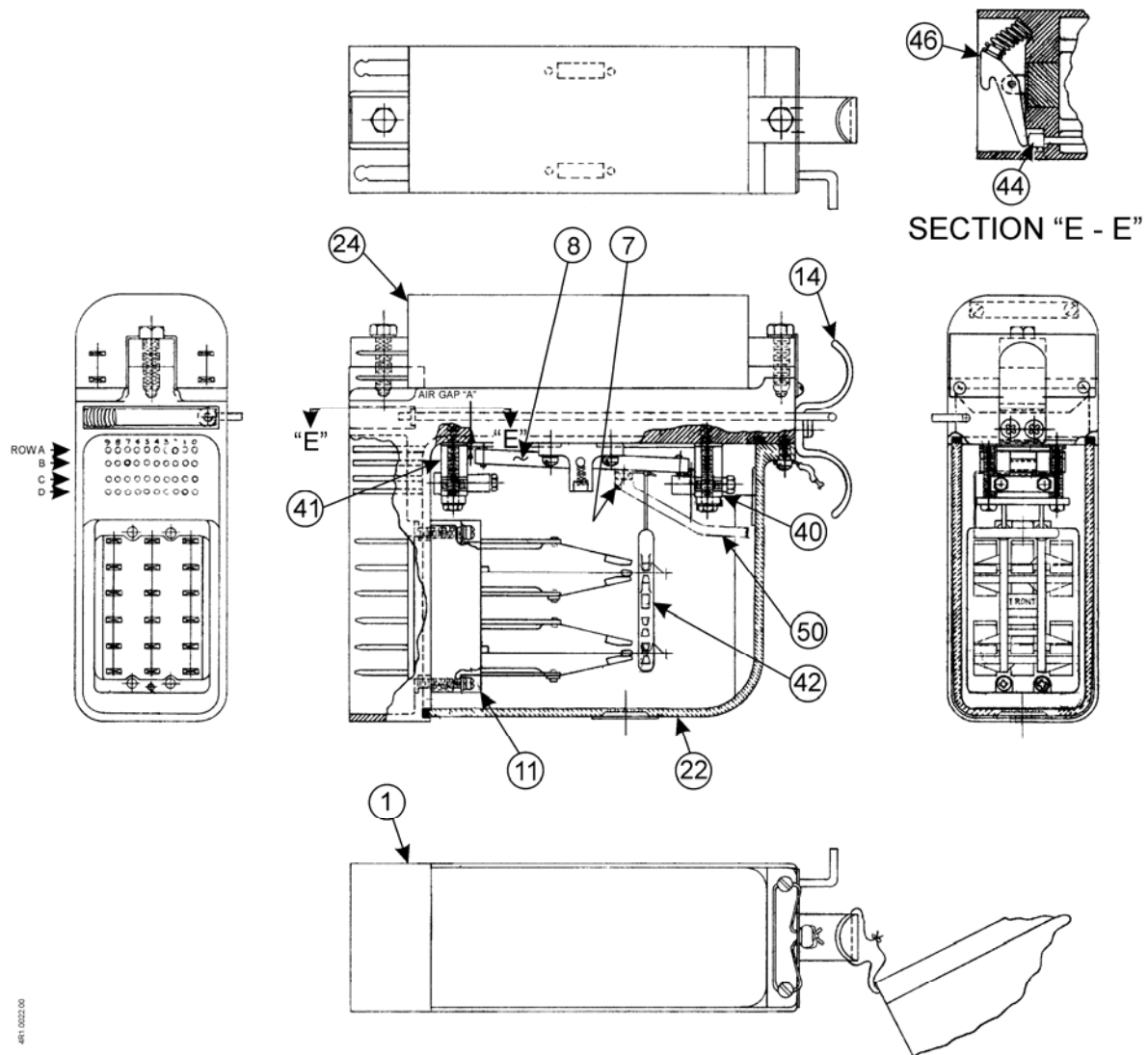


Figure 5-1. PP-151 Magnetic Stick DC Relay

**Table 5-2. Car-Carried PP-151 Magnetic Stick DC Relay - PN N437657
(See Figure 5-2)**

ITEM NUMBER	DESCRIPTION	PART NUMBER
1	Relay Frame	M437648
7	Armature Bracket PN-159B	M436773
8	Armature	N437638001
11	Contact Block	N438628
14	Pull Handle, Aluminum	J561111
22	Molded Relay Cover	J776596
24	Encapsulated Coil	N436791
40	Magnet, Permanent	M437642
41	Magnet, Permanent	M437891
42	Arm, Operating	M373632001
44	Indicator, Arm	M432380

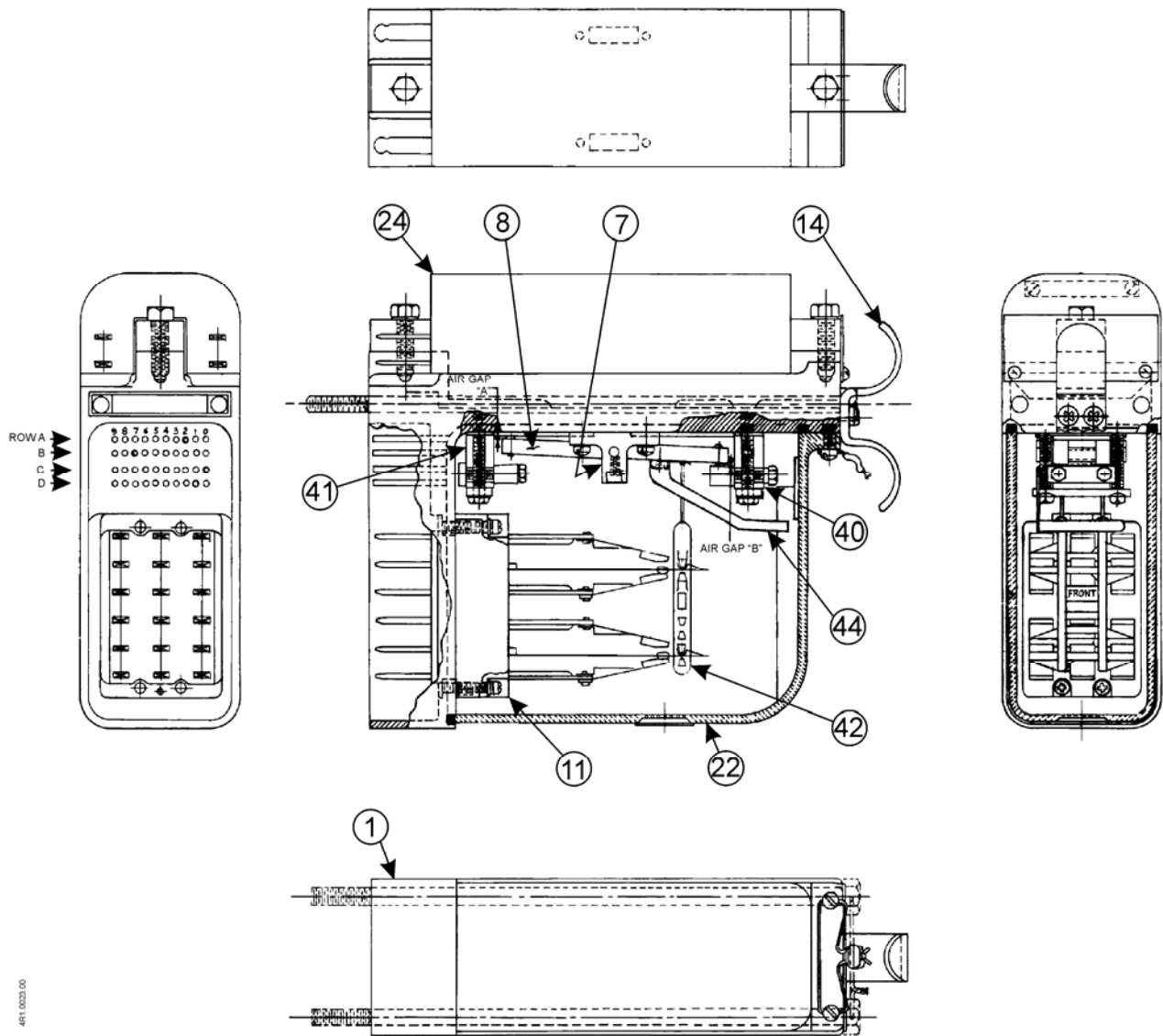


Figure 5-2. Car Carried PP-151 Magnetic Stick DC Relay

Table 5-3. Parts List for Old Mounting Base (See Figure 5-3)

Item	Part No.	Description
	N341785	Base, Wayside
	N437090	Base, Car-Carried
1a	J680179	Receptacle Contact Spring, Solderless Type #18 to #20 Wire
1b	J680165	Receptacle Contact Spring, Solderless Type #14 to #16 Wire
1c	J680181	Receptacle Contact. Spring, Solderless Type #10 to #12 Wire
17	N322965	Meter Test Plug
18	J077931	Insulated Test Plug (For opening any coil or contact circuit for removing receptacle springs)
<p>NOTE</p> <p>When mounting base complete is ordered, a bag of parts is included in the inner carton with the mounting base and instruction prints.</p> <p>The bag contains tags, screws, and washers which are used for attaching the mounting base to the rack.</p> <p>Also included the required quantity of receptacle contact springs (solderless) J640165 for #14 to #16 wire. If a different wire size is used, request the proper part number as shown in Item 1 when ordering the complete base.</p>		

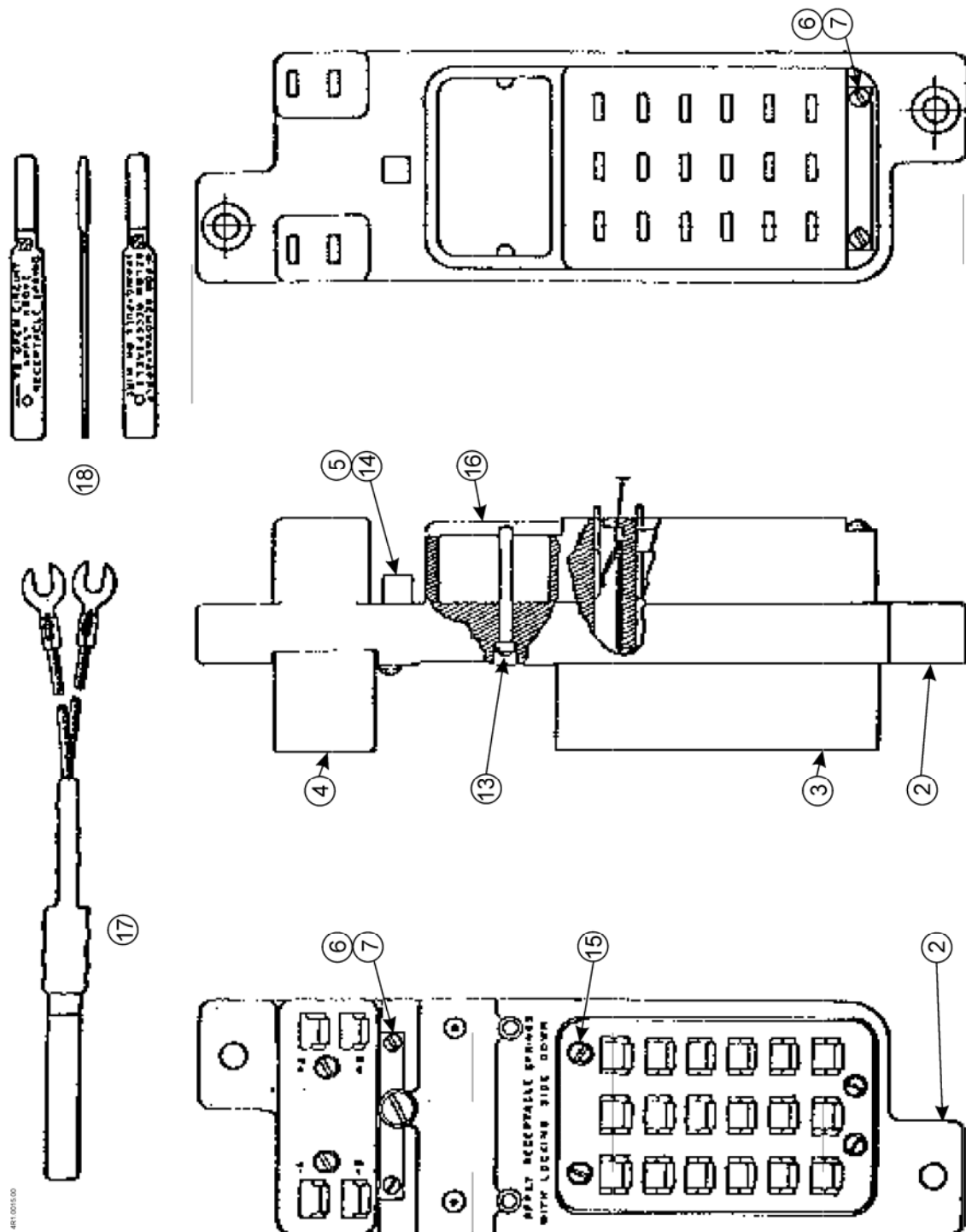


Figure 5-3. Old Style Mounting Base for PP-151 Relays

Table 5-4. Parts List for Improved Mounting Base (See Figure 5-4)

Item	Part No.	Description
1a	N451376-0302	Base Complete for Wayside Relays (See Note)
1b	N451376-0301	Base Only
1c	N451376-0303	Base Complete for Car Carrying Relays (See Note)
5	M451152-2702	Receptacle Contact Spring
NOTE		<p>When mounting base complete is ordered, a bag of parts is included in the inner carton with the mounting base and instruction prints.</p> <p>The bag contains tags, screws, washers, and nuts which are used for attaching the mounting base to the rack.</p> <p>The receptacle contact springs that are normally included are (M451142-2702) for #14 and #16 wire. If a different wire size is used, the appropriate part number should be specified when ordering the complete base (M451142-2701 for #18-20 wire or M451142-2703 for #10-12 wire). If solderless receptacle springs are needed, order M451142-2703.</p>

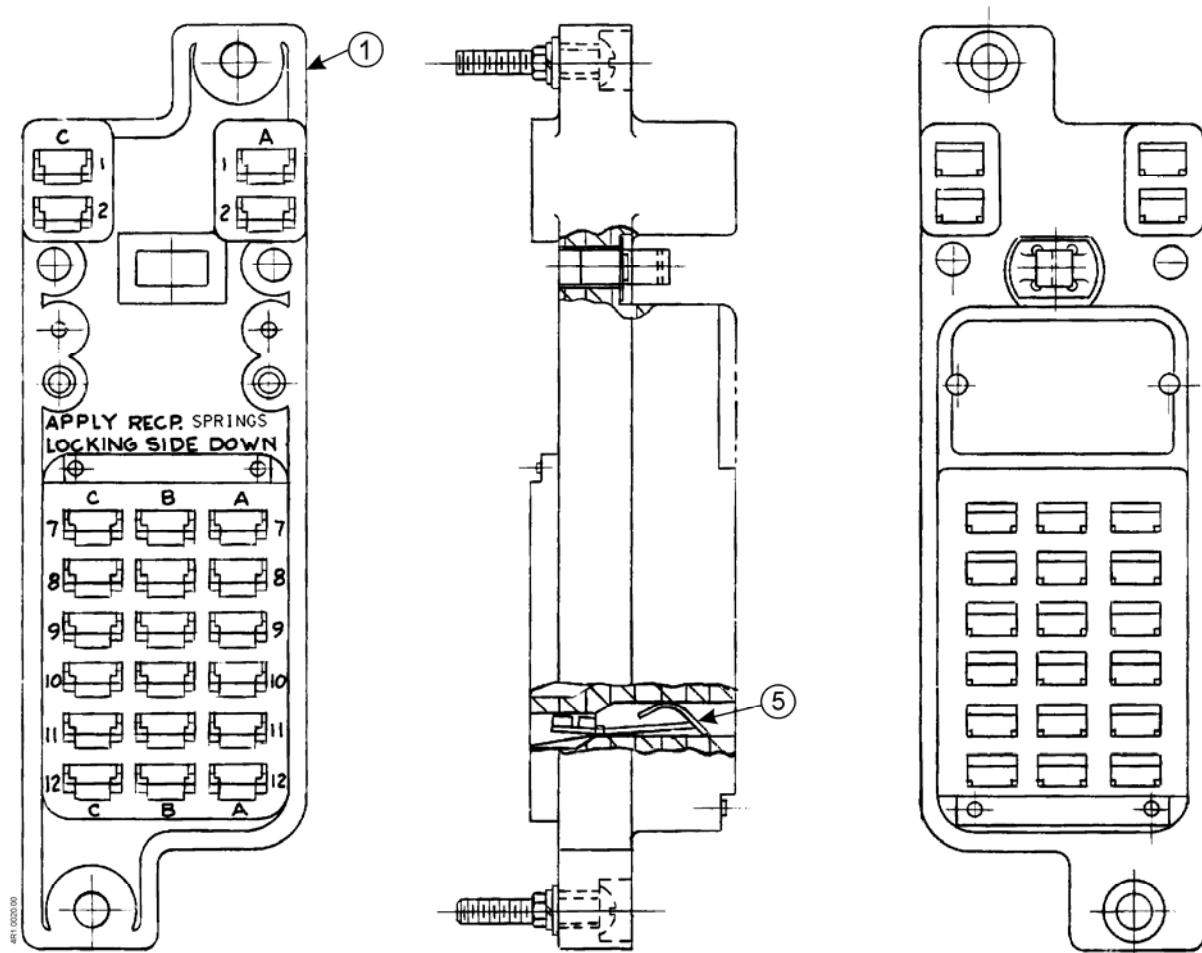


Figure 5-4. Improved Mounting Base for PP-151 Relays

6. RAIL TEAM AND TECHNICAL SUPPORT

The Rapid Action Information Link Team (RAIL Team) is a group of experienced product and application engineers ready to assist you to resolve any technical issues concerning this product. Contact the RAIL Team in the United States at 1-800-652-7276 or by e-mail at railteam@switch.com.



